LEONARD M. OSBORNE - CE 38573 DAVID R. GERVAN - CE 57282 DAVID N. LINDBERG - PG 5581/CEG 1895 FRANK R. BICKNER - PG 7428

RONALD C. CHANEY, Ph.D . CE 29027/GE 00934

November 23, 2005

3577.02

Humboldt County Department of Health & Human Services Division of Environmental Health 100 H Street, Suite 100 Eureka, California 95501

Attention: Mr. Mark Verhey

Subject: Response to Correspondence

HPI Rio Dell Shell; 481 Wildwood Avenue, Rio Dell, California

LOP No. 12261

Dear Mr. Verhey:

LACO ASSOCIATES (LACO) presents this letter to the Humboldt County Division of Environmental Health (HCDEH) in response to HCDEH correspondence dated October 7, 2005, concerning the subject property in Rio Dell, California (Figure 1). This HCDEH correspondence was in response to the August 2005 submittal of LACO's *Remedial Action Plan* (RAP). We will note the HCDEH's comments in italics, followed by LACO's response.

The Remedial Action Plan recommends installing an oxidation system. We do not concur. We require you submit a report addressing the costs and benefits of a minimum of three alternatives.

A feasibility study examining a minimum of three alternatives will be submitted after we receive a response from the HCDEH regarding the issues discussed in this letter. The issues discussed in this letter include closing data gaps in LACO's understanding of the extent of impacted soil and groundwater, specifically the lateral and vertical extent of dissolved-phase methyl tertiary butyl ether (MTBE). Examining alternatives, and ultimately choosing a suitable remedial alternative, is dependant on closing the data gap in sorbed- and dissolved-phase impacts at this site.

Within this report is a workplan to install a monitoring well and nine temporary borings. We do not concur with the proposed monitoring well. We recommend the results of borings be used to optimally locate any future monitoring wells. In addition, because this is a site with MTBE as a constituent of concern, the vertical delineation of MTBE and the proposed screen interval of monitoring wells are important to understand prior to installing any wells.

We agree with your assessment regarding the vertical delineation of constituents of concern (COCs) regarding the screen interval of monitoring wells, prior to the installation of monitoring wells. On page nine of LACO's RAP, we recommended:

'the installation of an additional monitoring well outside the treatment zone, with a screen to be determined after receipt of the analytical results of the boring installation.'

Towards this end, we continue to recommend the installation of the nine temporary borings proposed in LACO's RAP. LACO's reasoning behind the proposed borings is included below. Should the HCDEH agree with LACO's recommendation to install the nine temporary borings proposed in LACO's RAP, we will use the analytical and stratigraphic results of the boring installation to optimally locate any future monitoring wells.

We understand the purpose of the temporary borings is to help delineate the MTBE plume. However, we do not understand the strategy behind some of these proposed borings. Specifically, we are unclear what question will be addressed with the four borings proposed easterly of the former UST. The historic data records a majority of the contamination to the northeast, in the vicinity of the proposed monitoring well. We do not concur with the proposed borings located easterly of the former UST. Alternatively, submit a revision and response to this correspondence addressing our concern.

As indicated in LACO's RAP, one of the four borings proposed easterly of the former UST is a hand-auger boring. This hand boring is one of a pair of hand-augered borings intended to determine the potential impact of the dissolved-phase hydrocarbon plume on the utility trench located adjacent to the site, with the second boring of the hand-augered pair located northwest of the site, within the adjacent utility trench. These hand-augered borings were proposed in anticipation of the HCDEH requesting them, based on site conditions and previous correspondence. In correspondence dated July 9, 2003, the HCDEH requested clarification regarding the potential for the sanitary sewer adjacent to monitoring well MW8 to act as a preferential pathway. Additionally, as indicated in LACO's RAP:

'these borings will be installed only if the HCDEH deems it necessary to investigate the trench's fill material for dissolved-phase hydrocarbon contamination before site closure can be considered.'

Other proposed borings located easterly of the former underground storage tank (UST) include one to be installed within the site's upper water-bearing unit and two to be installed within the site's lower water-bearing unit. The temporary boring proposed for within the site's upper water-bearing unit is intended to close data gaps in the lateral delineation of dissolved-phase total petroleum hydrocarbons as gasoline (TPHg), MTBE, tertiary amyl methyl ethane (TAME), tertiary butyl alcohol (TBA), and ethyl tertiary butyl ether (ETBE). The two temporary borings proposed for within the site's lower water-bearing unit are hydropunch borings intended to assist in the lateral and vertical delineation of dissolved-phase TPHg, MTBE, TAME, TBA, and ETBE. The borings proposed for the region easterly of the former UST are part of an effort to close data gaps in the lateral and vertical delineation of impacted groundwater and, in LACO's opinion, are important to gain an understanding of the extent of impacted groundwater.

The data gaps in LACO's understanding of the extent of impacted groundwater, particularly the lateral and vertical extent of dissolved-phase MTBE impacts, led us to propose the nine temporary borings indicated on Figure 3 of the RAP. We feel that the proposed borings will enhance LACO's understanding of the lateral and vertical extent of dissolved-phase MTBE impacts, especially given that previous subsurface investigations did not result in adequate information regarding the extent of dissolved-phase MTBE. Furthermore, previous investigations at this site have indicated the possibility of dissolved-phase MTBE impacts to the deep water-bearing unit at this site. For example, the laboratory analytical results of boring B2-01, installed northeast and hydraulically downgradient of the former UST cavity, indicated MTBE concentrations in soil increasing with depth. The laboratory analytical results of boring B2-01, installed in June 2001, are contained in Table A, included below.

	Table A: Laboratory Analytical Results, Boring B2-01									
1 20.								o-Xylene (μg/g)		
B2-01	6/13/01	5	<1.0	0.060	< 0.0050	0.0083	< 0.0050	0.0089	<0.0050	
B2-01	6/13/01	9	<1.0	0.073	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	
B2-01	6/13/01	12	<1.0	0.19	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	

In LACO's RAP, we also proposed borings easterly of the former UST due to historic gradient calculations. Dating to the June 2001 shallow monitoring well installation and deep well reconstruction, hydraulic gradient directions for the shallow and deep monitoring wells have varied widely. Historic hydraulic gradient slopes and directions dating to the June 2001 shallow monitoring well installation and deep well reconstruction are contained in Table 1. The range of hydraulic gradient directions is large enough, and combined with the data gaps regarding the extent of impacted groundwater, that we feel justified in the intent and number of proposed borings.

There are nested monitoring wells at the site. The deep monitoring well MW2 shows lower levels of contamination than the adjacent shallow monitoring well MW5. In contrast, the deep monitoring well MW3 records greater levels of contamination than the adjacent shallow monitoring well MW4. Please comment on this observation and provide an interpretation regarding site conditions, and your conceptual model of contaminant distribution and potential fate. Additionally, please indicate what the screen intervals are on either a separate table or on the existing tables.

Regarding the distribution of petroleum hydrocarbons, the monitoring wells were installed within differing zones of sorbed-phase petroleum hydrocarbon impacts. An assessment of the nested monitoring well pairs discussed in the October 7, 2005, HCDEH correspondence follows. A table illustrating the screen intervals, stratigraphy, and impacted zones of monitoring well nested pairs MW2/MW5 and MW3/MW4 is included below as Table B.

Shallow Monitoring Wells MW4/MW5 Comparison

The difference in dissolved-phase analytical results between shallow monitoring wells MW4 and MW5 appears to reflect the difference in sorbed-phase analytical results of the

well's installations. As illustrated in Table B, shallow monitoring well MW5 appears to have been installed within a 12-foot interval of soil impacted by TPHg and benzene. Sorbed-phase TPHg concentrations within the screened interval of monitoring well MW5 are among the highest reported for the site. As such, we would expect the laboratory analytical results from quarterly groundwater sampling to reflect the relatively high soil laboratory analytical results. The dissolved-phase laboratory analytical results from monitoring well MW5 are among the highest reported for the site, with monitoring well MW7 reporting TPHg concentrations within the same order of magnitude as those reported for monitoring well MW5. Likewise, laboratory analytical results for benzene in groundwater samples collected from monitoring well MW5 are the highest onsite. No other onsite monitoring well has reported benzene during the previous hydrologic cycle, nor has any other monitoring well reported sorbed-phase benzene concentrations during installation.

Laboratory analytical results from the installation of shallow monitoring well MW4 indicate that sorbed-phase MTBE was reported at 5 feet below ground surface (bgs). Because it appears that monitoring well MW4 was installed within impacted soils with lower concentrations than those of monitoring well MW5 and with dissimilar analyte detections, it appears reasonable that the quarterly groundwater laboratory analytical results of monitoring well MW4 reflect the relatively low soil laboratory analytical results. Historic groundwater analytical results indicate that monitoring well MW4 consistently reported dissolved-phase fuel oxygenates, save for the occasional detection of TPHg.

Table I	Table B: Features of Nested Monitoring Well Pairs MW2/MW5 and MW3/MW4.								
Nested		Screen	Laboratory Analytical Results,						
Monitoring	Monitoring	Interval	Monitoring Well Installation						
Well Pair	Well	(feet bgs)	(μg/g, feet bgs)						
	MW2	18 - 25	MTBE = 0.041 @ 5'						
	(deep)		MTBE = 0.066 @ 10'						
7 44440 0 44414	MW5	5 - 12	TPHg = 110 @ 1'; Benzene = 0.80 @ 1'						
MW2/MW5	(shallow)		TPHg = 400 @ 4'; $Benzene = 2.5 @ 4'$						
			TPHg = 110 @ 9'; Benzene = 0.13 @ 9' TPHg						
			= 18 @ 12'; Benzene = 0.017 @ 12'						
	MW3	13 - 20	TPHg = 0.016 @ 5'						
3 43370 /3 4337 4	(deep)		TPHg = 0.012 @ 10'						
MW3/MW4	MW4	7 - 12	MTBE = 0.059 @ 5'						
	(shallow)								

Deep Monitoring Wells MW2/MW3 Comparison

Monitoring well MW2 is screened below the location of sorbed-phase analytical results reported for this well's installation. However, it appears that the groundwater laboratory analytical results of monitoring well MW2 generally reflect the relatively low sorbed-phase MTBE analytical results reported for the installation of monitoring well MW2. Monitoring

well MW2 has consistently reported dissolved-phase fuel oxygenates, save for the occasional detection of TPHg.

Similar to monitoring well MW2, monitoring well MW3 appears to be screened below the location of sorbed-phase analytical results reported during the installation of monitoring well MW3. Additionally, the quarterly groundwater laboratory analytical results of monitoring well MW3 appear to reflect the relatively low sorbed-phase analytical results reported for soil samples obtained during the well's installation. Monitoring well MW3 has consistently reported dissolved-phase TPHg and fuel oxygenates during quarterly groundwater monitoring.

Screen intervals of the site's monitoring wells are illustrated below in Table C. Hereafter, LACO will make an effort to include monitoring well screen intervals on quarterly groundwater analytical tables for all of LACO's UST sites.

Table C: Screen Interv	Table C: Screen Intervals, HPI Rio Dell Shell Monitoring Wells						
Monitoring Well	Screen Interval (feet bgs)						
MW1	18 - 25						
MW2	18 - 25						
MW3	13 - 20						
MW4	7 - 12						
MW5	5 - 12						
MW6	5 - 12						
MW7	5 - 12						
MW8	5 - 12						
MW9	5 - 12						
MW10	5 - 12						

In Figure 4, the northeast edge of the estimated plume is drawn with a solid line, indicating a high level of confidence. It is unclear to us what information is being used to support this interpretation. As mentioned in previous correspondences, no water samples were collected from boring numbers B6 to B14. Additionally, we did not find analytical results from B11 in the recent report.

Figure 4 illustrates dissolved-phase MTBE isoconcentrations. The Figure 4 submitted with LACO's RAP did not include a statement indicating that isoconcentration lines represented laboratory analytical results in micrograms per liter ($\mu g/L$). Please find a corrected Figure 4 included with this correspondence.

Regarding the solid line on the northeast edge of the estimated plume, we recognize that groundwater samples were not collected during the installation of borings in this vicinity. The solid line representing the estimated dissolved-phase MTBE isoconcentrations in this area were based on quarterly groundwater laboratory analytical results of monitoring wells MW7 and MW9, as well as a conversion from sorbed-phase laboratory analytical results to

dissolved-phase laboratory analytical results. Text at the bottom of Figure 4 reads:

'Note: Soil analytical data converted to groundwater concentrations where no groundwater analytical data available'.

Sorbed-phase laboratory analytical results were converted to dissolved-phase laboratory analytical results using the following approximation:

*Groundwater analytical approximation = soil analytical results * porosity * 1,000*

where:

- groundwater analytical approximation are in units of μg/L, or parts per billion
- soil analytical results are in units of micrograms per gram ($\mu g/g$), or parts per million
- porosity (unitless) is the approximate porosity of the lean clay with silt unit reported for the 8- to 12-foot intervals in borings B7 and B11. The American Petroleum Institute indicates a porosity approximation for clayey silt as 0.40 (API, 2004).

LACO approximations of groundwater laboratory analytical results using this conversion are detailed below in Table D. Additionally, monitoring wells MW7 and MW9 have reported maximum dissolved-phase MTBE concentrations of 1,300 μ g/L and 460 μ g/L, respectively, and these maximum values were used to conservatively represent LACO's interpretation of the estimated dissolved-phase MTBE isoconcentrations in this area. LACO has resubmitted Figure 4 with this correspondence, and has updated the isoconcentration lines in the northeast edge of the estimated dissolved-phase MTBE plume to reflect the approximated nature of the data.

Tabl	Table D: Soil Analytical Data to Groundwater Analytical Data Approximation Conversion Details									
		Sorbed-phase MTBE			Groundwater Analytical					
	Sample	Laboratory			Result					
Boring	Depth	Analytical	Porosity	Conversion	Approximation					
ID	(feet bgs)	Result (µg/g)	(dimensionless)	Factor	(µg/L)					
В3	10	0.11	0.40	1,000	275					
B2-01	12	0.19	0.40	1,000	475					

Regarding the laboratory analytical results from boring B11, a review of the environmental boring log for boring B11, and the chains of custody for the August 2002 installation of borings B6 through B13, indicates that soil samples from B11 and B7 were not submitted for laboratory analysis. Copies of the environmental boring logs for borings B7 and B11 are included as Attachment 1. The environmental boring log for B11 indicates that the sample from 4 to 8 feet bgs was lost during retrieval, and no samples were obtained from the 0 to 4 feet bgs or 8 to 12 feet bgs intervals. It appears that a soil sample from boring B7 was obtained solely for stratigraphic analysis. A copy of the particle size analysis results from

boring B7 is included as Attachment 2.

We recommend the existing and potential fate of contaminants be addressed to a level of detail necessary to design an effective remediation system.

LACO agrees that the existing and potential fate of contaminants be addressed to a level of detail necessary to design an effective remediation system. The selection of an effective remedial alternative is contingent on the lateral and vertical delineation of sorbed- and dissolved-phase impacts at this site. For this reason, LACO reiterates the recommendation for installation of the nine temporary borings proposed in the RAP. We feel that these borings are necessary to close data gaps in the lateral and vertical delineation of sorbed- and dissolved-phase impacts at this site, are crucial in determining existing and potential fate of contaminants and, finally, are vital for the design of an effective remedial solution.

We respectfully request a reply to this letter, addressing LACO's concerns regarding the lateral and vertical delineation of sorbed- and dissolved-phase impacts at this site and LACO's recommendation for the installation of the nine temporary borings proposed in the RAP. A feasibility study examining a minimum of three alternatives and their costs will be submitted following a response from HCDEH. Examining alternatives, and ultimately choosing a suitable remedial alternative, is dependant on closing the data gap in sorbed- and dissolved-phase impacts at this site.

LIST OF FIGURES, TABLES, AND ATTACHMENTS

Figure 1 Location Map

Figure 4 MTBE Isoconcentration Map

Table 1 Historic Hydraulic Gradient Data

Attachment 1 Environmental Boring Logs for Borings B7 and B11

Attachment 2 Particle Size Analysis Results from Boring B7

REFERENCES

American Petroleum Institute (API), 2004 LNAPL Interactive Guide version 2.0, captured from http://groundwater.api.org/lnaplguide/download.cfm (October 2005)

Please contact us if you have any questions or require additional information.

Sincerely,

LACO ASSOCIATES

V.T. Sulli

Vincent T. Sullivan, EIT

Staff Engineer

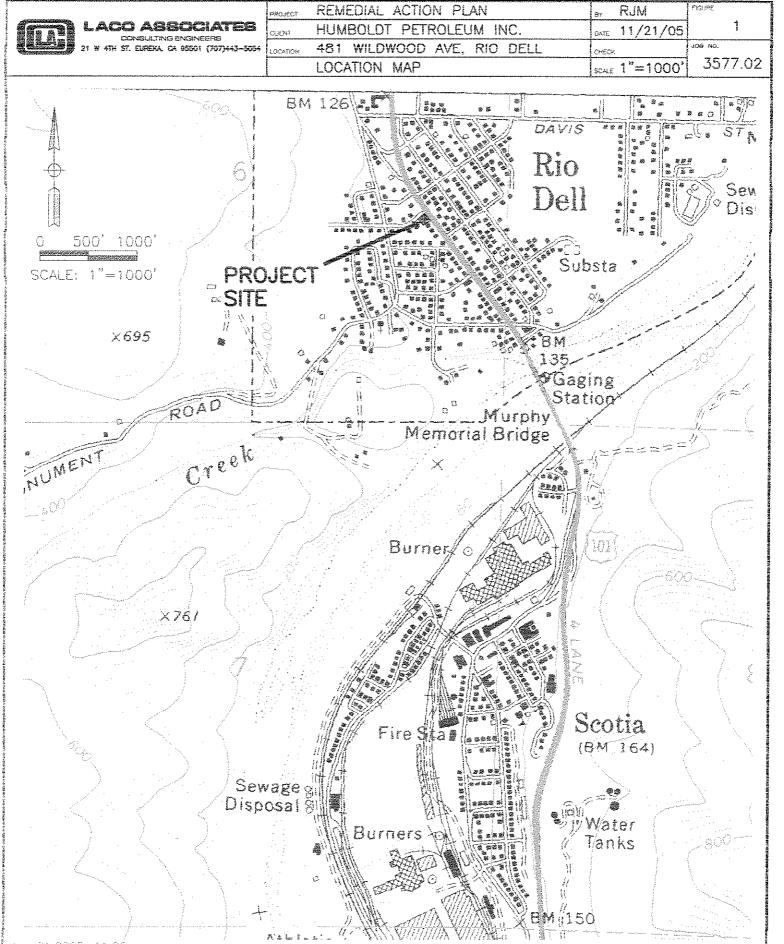
Γimothy D. Nelson

Project Manager

VTS/TDN:jg

cc: Jim Seiler, HPI (electronically sent)

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| Nov. 23,2005—13:26am | ENCADELESN3500N3577 | HPL Piol Dell ShelfNdwgN3577—RAP | june05N | 357703Loc.dwg



PROJECT REMEDIAL ACTION PLAN

CLIENT HUMBOLDT PETROLEUM INC

LOCATION 481 WILDWOOD AVE, RIO DELL

MTBE ISOCONCENTRATION MAP

BY RJM

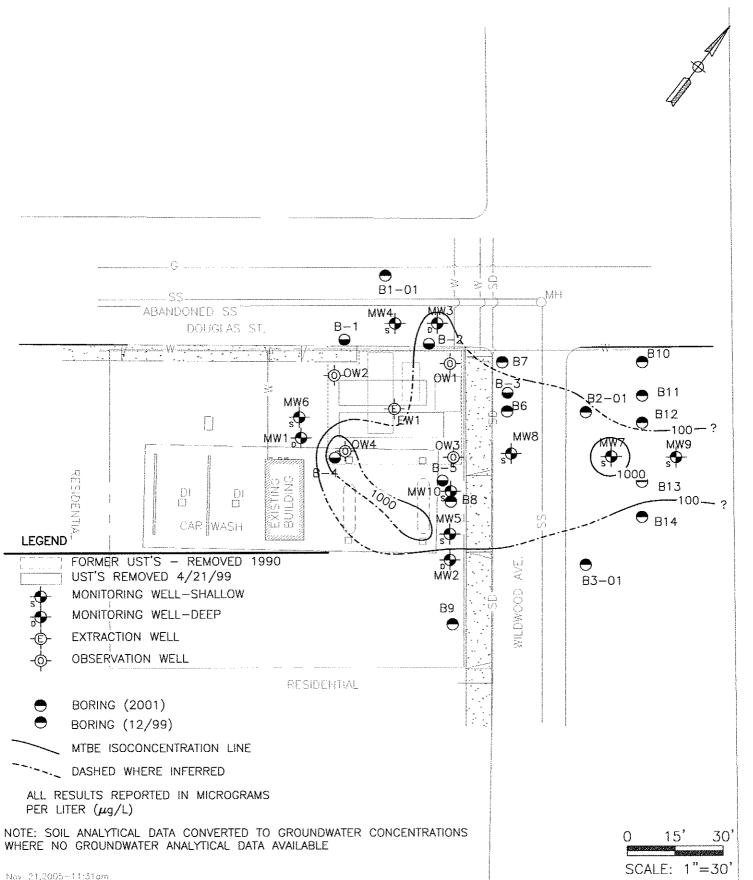
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JOB NO.

3577.02



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TABLE 1: HISTORIC HYDRAULIC GRADIENT DATA

Former Rio Dell Shell, 481 Wildwood Ave., Rio Dell, CA

LACO Project No. 3577.02; LOP No. 12261

	Shallow A	Aquifer	Deep Aquifer		
Date	Direction	Slope (%)	Direction	Slope (%)	
	shallow wells		deep wells		
6/1/2001	installed		reconstructed		
7/6/2001	N73°E	4.5	S11°W	0.70	
9/4/2001	S31°W	5.5	S20°W	0.70	
10/18/2001	S87°W	2.7	N56°W	0.03	
11/29/2001	S45°W	3.6	N35°W	0.10	
1/2/2002	S35°W	1.8	N50°W	0.07	
1/21/2002	N89°E	0.6	N76°W	0.04	
2/27/2002	S20°W	5	N1°W	0.15	
3/13/2002	S54°W	5.1	N27°W	0.10	
4/19/2002	N85°E	1	N14°W	0.20	
5/20/2002	N49°E	0.45	S41°E	0.03	
6/13/2002	N21°W	1.36	S52°W	0.44	
10/31/2002	N46°E	5.6	N77°W	9.30	
1/3/2003	S85°W	4	N61°W	0.26	
3/18/2003	N9°W	3.5	N50°E	6.30	
6/24/2003	N20°W	4.3	S77°E	0.01	
9/18/2003	N40°W	5.5	N79°E	0.05	
12/9/2003	N21°E	1.1	S52°E	0.01	
3/4/2004	N73°W	4.3	N50°E	0.08	
6/23/2004	N57°W	5.3	S77°E	0.05	
9/14/2004	N34°E	6.7	S77°E	0.07	
12/16/2004	N3°E	10.9	N72°E	0.02	
3/15/2005	N8°W	7.6	N55°E	0.10	
6/8/2005	N33°W	5.6	N75°W	1.3	
9/22/2005	N3°W	6.0	N54°E	0.03	

Attachment 1

ENVIRONMENTAL BORING LOG

Boring No.

B7

PROJECT: RIO DELL SHELL

PROJECT NO.: 3577.02

BORING LOCATION: Southwest corner of Wildwood and Douglas DATE: 8-28-02 DRILLING METHOD: DIRECT PUSH

ELEVATION:

DRILLER: LAKE'S

LOGGED BY: GJE

COMPLETION ₹ : NO WATER

DEPTH TO WATER: INITIAL ₩ : NO WATER SITE GEOLOGY: FLUVIAL TERRACE

SITE GEOLOGY: FLUVIAL TERRACE									
ELEVATION/	SAMPLERS	USCS	Description	P.I.D. ppm	Hanby result				
DEPTH4	AND TEST DATA	FILL	CLAYEY GRAVEL FILL: Moist to wet						
e de la companya de l		CL	LEAN CLAY WITH SILT: Stiff, low plasticity, moist, dark gray with mottles, 30% clay, 70% silt						
6	-	CL	LEAN CLAY WITH SILT: Stiff, medium plasticity, moist, dark gray with mottles, 30% clay, 60% silt, 10% fine sand						
- - 8 -	-	CL	LEAN CLAY WITH SILT: Stiff, medium plasticity, moist, gray with light brown mottles, 45% clay, 55% silt						
10									
- - - 12			BOTTOM OF EXCAVATION AT 12 FEET IN SAME						
- 14	s.								
-									
— 16 - -	3								
- 18	1								
,		L	I		<u> </u>				

No core collected from 0 to 4 feet bgs.

	ure		

ENVIRONMENTAL BORING LOG

Boring No.

PROJECT: RIO DELL SHELL

BORING LOCATION: East side of Wildwood Ave

DRILLING METHOD: DIRECT PUSH

DRILLER: LAKE'S

DEPTH TO WATER: INITIAL \(\frac{\begin{array}{c} \text{NO WATER} \end{array} \)

PROJECT NO.: 3577.02

DATE: 8-29-02

ELEVATION:

LOGGED BY: GJE

COMPLETION ₹: NO WATER

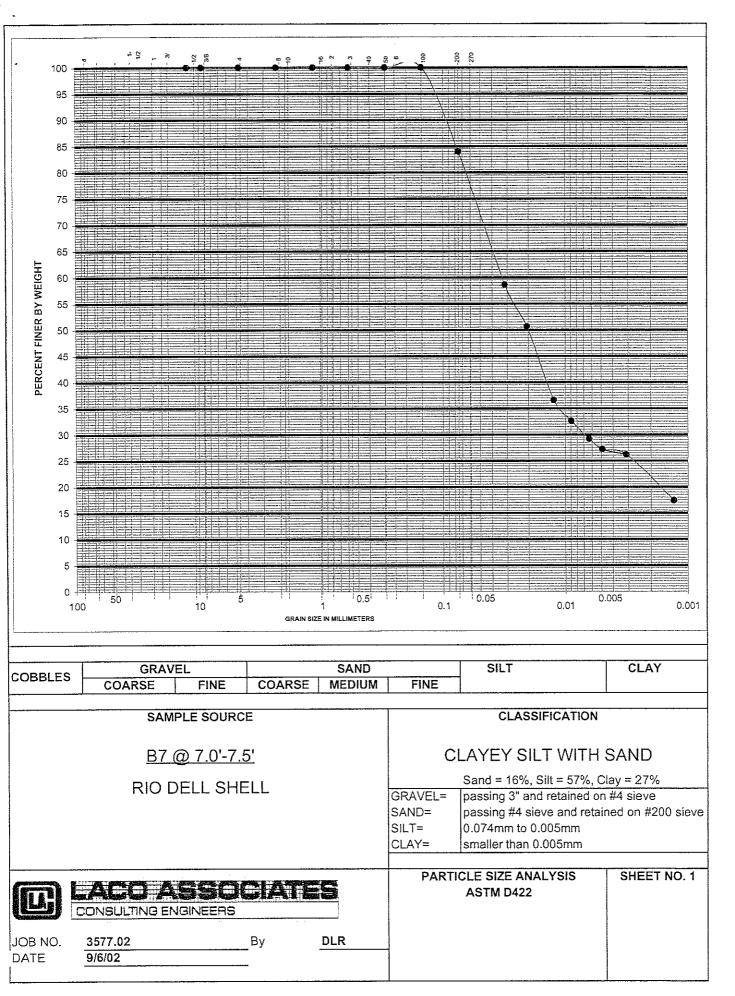
SITE GEOLOGY: FLUVIAL TERRACE

ELEVATION/	SOIL SYMBOLS, SAMPLERS	uscs	Description	P.I.D. ppm	Hanby result
<u> DEPTH </u> - -	AND TEST DATA	FILL	ASPHALT AND AGGREGATE BASE		
2			Sample not recovered. Base of fill saturated at approximately 8 feet bgs.		
8		CL	LEAN CLAY WITH SILT: Stiff, low plasticity, moist, light gray with dark yellowish brown mottles, 30% clay, 60% silt, 10% fine sand		
1.0		CL	LEAN CLAY WITH SILT: Stiff, low to medium plasticity, moist, dark yellowish brown with light gray, 30% clay, 70% silt		
- - 12 - -			BOTTOM OF EXCAVATION AT 12 FEET IN SAME		
14					

Sample from 4 to 8 feet bgs was lost during retrieval.

Fig	ure

Attachment 2





Project	MATERIAL TESTING	By DLR	Pg no. 1
Location	RIO DELL SHELL	Date 9/6/02	
Client	HPI	Checked	Job no. 3577.02
	02-124	Date 2 /28/03	0077.02

21 W. 4th Street, Eureka California 95501

Particle Size Analysis, ASTM D-422

Sample Location

B7 @ 7.0'-7.5'

Total Sample

231 grams

Hydrometer Sample

50 grams

100.0% < #10 Sieve

Start Time

9:56:00

Reading Time	Elapsed Time (Minutes)	Temp.	Actual Reading	Corrected Reading	% in Suspension	Table 3	Table 2	Particle Diameter (mm)
	(T)			(R)	(P) [*]	(K)	(L)	(D)
9:58:00	2	67	36	29.3	58.6	0.01375	10.4	0.0314
10:01:00	5	67	32	25.3	50.6	0.01375	11.1	0.0205
10:11:00	15	67	25	18.3	36.6	0.01375	12.2	0.0124
10:26:00	30	67	23	16.3	32.6	0.01375	12.5	0.0089
10:56:00	60	68	21	14.6	29.2	0.01365	12.9	0.0063
11:36:00	100	68	20	13.6	27.2	0.01365	13.0	0.0049
2:06:00	250	71	19	13.1	26.2	0.01337	 13.2	0.0031
9:56:00	1440	69	15	8.7	17.4	0.01356	13.8	0.0013

Assumptions:

- 1) Specific Gravity of 2.65
- 2) Hygroscopic Moisture Factor of 1

Percent in Suspension = (R/W) x 100

Particle Diameter (mm) = K times square root of (L/T)

Values for % in suspension adjusted to reflected % of total sample